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Note on the Moon's Eclipse Diameter. By A. C. D. Crommelin.

The results of the total solar eclipses of 1898 and 1900 have established beyond a doubt that the value of the Moon's semi-diameter now used in the *Nautical Almanac* for eclipses and occultations gives too long a duration for totality. This value (15′ 32″·65) was deduced by Dr. L. Struve from a discussion of the occultations observed during the total lunar eclipses of 1884 and 1888.

The American ephemeris uses the value 15′ 31″·76 for eclipses and occultations, and increases this by 2″·5 for meridian observations of the bright limb.

Now the American ephemeris durations of totality were very nearly correct in the above eclipses, from which it seems clear that their value of the semi-diameter is preferable to the *Nautical Almanac* one for this purpose.

Now it occurred to me recently that the reason that a value deduced from a large number of occultations does not give correct results for total eclipses is to be sought in the great irregularity of the Moon's limb. I was particularly struck with this in watching the disappearing Sun last May. Twenty seconds before totality the lunar mountains began to break the continuity of the solar crescent, and a few seconds before totality there was no semblance of a continuous crescent, only a row of bright beads and patches. I have drawn a figure representing diagrammatically on a greatly exaggerated scale these irregularities in the Moon's outline. The outer circle is drawn to embrace the highest mountains, the inner through the deepest valleys, while the middle one is drawn midway between the two. Now it seems clear that the discussion of a large number of occultations at various points of the limb would give us the diameter of this middle circle. But since we do not call the Sun totally eclipsed if any portion of it is visible through a lunar valley, the inner circle represents the effective diameter of the Moon as regards her power of totally eclipsing the Sun. The difference between the *Nautical Almanac* and American Ephemeris values only implies an extreme depth of the deepest lunar valleys below the mean level of about 5,000 feet, which is not at all an improbable amount. The course then that I should recommend is as follows: Struve's semi-diameter of the Moon should certainly be used for occultations, and it may be used for the prediction of first and fourth contacts of total eclipses; also for partial and annular eclipses, whose accurate prediction is of minor importance. But it is so important to predict the duration and boundaries of totality with all possible accuracy that I think it would be well to use the American value, or even a slightly smaller one (say 15′ 31″·70) for this purpose. I think this

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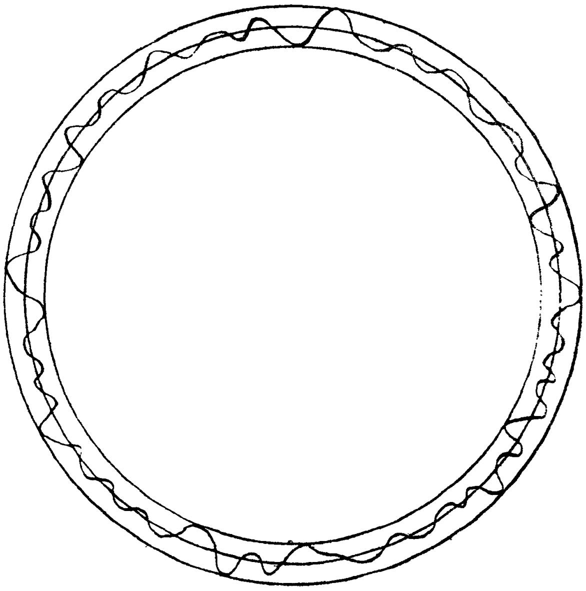
would give the duration with almost perfect accuracy ; if anything it would underestimate it, but that is on the safe side.

Curiously enough, in 1902, the American Ephemeris adopts the value 15′ 32″·55 for eclipses and occultations, and increases it by 1″·5 for meridian observations of the bright limb.

I regard this as a distinctly retrograde step as regards total eclipses, though it is probably an improvement as regards occultations.

Perhaps I may point out a small erratum in Mr. Penrose's paper in the *Monthly Notices* for April last (lx. 7, p. 483).

He says, "Compare the arguments given for the . . . . Moon's semi-diameter in the *Nautical Almanac* for the same day at noon . . . . then find from these the corrections required for the assumed time in simple proportion." He has overlooked the fact that the Moon's semi-diameter under the heading eclipses is based on Struve's semi-diameter 15′ 32″·65, while the noon and midnight values are based on Hansen's bright limb semi-diameter 15′ 34″·07. It will be near enough if the noon and midnight values are diminished by 1″·4 before proceeding to interpolate in the manner described by Mr. Penrose.



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Ephemeris for Physical Observations of the Moon for 1901.

By A. C. D. Crommelin.

Greenwich Midnight.		Selenographical		Geocentric Libration		Combined Amount.	Direction.	C.
		Colong.	Lat.	Sel. Long.	Lat.			
		of the Sun.		of the Earth.				
1901.								
Jan.	1	48°·76	+1°·00	+2°·82	+0°·19	2°·83	273°·9	347°·12
	2	60·89	+1·02	+3·60	+1·81	4·03	296·7	352·77
	3	73·01	+1·05	+4·23	+3·30	5·37	308·0	358·79
	4	85·14	+1·07	+4·68	+4·58	6·55	314·4	4·71
	5	97·26	+1·10	+4·87	+5·58	7·40	318·9	10·14
	6	109·39	+1·12	+4·85	+6·27	7·93	322·3	14·83
	7	121·53	+1·14	+4·50	+6·62	8·01	325·8	18·64
	8	133·66	+1·16	+3·87	+6·65	7·69	329·8	21·50
	9	145·80	+1·17	+2·96	+6 36	7·02	335·0	23·39
	10	157·95	+1·19	+1·84	+5·80	6·08	342·4	24·29
	11	170·10	+1·21	+0·56	+5·00	5·03	353·6	24·21
	12	182·26	+1·23	−0·80	+3·98	4·06	11·4	23·12
	13	194·42	+1·24	−2·15	+2·80	3·53	37·5	21·03
	14	206·59	+1·25	−3·39	+1·48	3·70	66·4	17·93
	15	218·76	+1·27	−4·43	+0·08	4·43	89 0	13·89
	16	230·94	+1·28	−5·20	−1·36	5·38	104 7	9·03
	17	243·13	+1·29	−5·63	−2·76	6·27	116·1	3·57
	18	255·31	+1·30	−5·68	−4·06	6·99	125 6	357·81
	19	267·50	+1·32	−5·34	−5·16	7·42	134·0	352·12
	20	279·69	+1·33	−4·65	−5·99	7·58	142·2	346·87
	21	291·89	+1·34	−3·68	−6·46	7·44	150·3	342·34
	22	304·07	+1·35	−2·51	−6·54	7·00	159 0	338·85
	23	316·26	+1·36	−1·26	−6·21	6·34	168·5	336·58
	24	328·44	+1·38	−0·03	−5·49	5·49	179·7	335·62
	25	340·61	+1·39	+1·10	−4·42	4·55	194·0	336·12
	26	352·78	+1·40	+2·08	−3·09	3·72	213·9	338·07
	27	4·94	+1·42	+2·90	−1·58	3·30	241·4	341·21
	28	17·09	+1·43	+3·55	0·00	3·55	270·0	345·85
	29	29·23	+1·44	+4·05	+1·56	4·34	291·1	351·21
	30	41·37	+1·45	+4·40	+3·02	5·34	304·5	357·03
	31	53·51	+1·47	+4·61	+4·30	6·30	313·0	2·89
Feb.	1	65·64	+1·48	+4·67	+5·32	7·08	318·7	8·43
	2	77·78	+1·49	+4·55	+6·05	7·57	323·1	13·35
	3	89·91	+1·50	+4·23	+6·46	7·72	326·8	17·45